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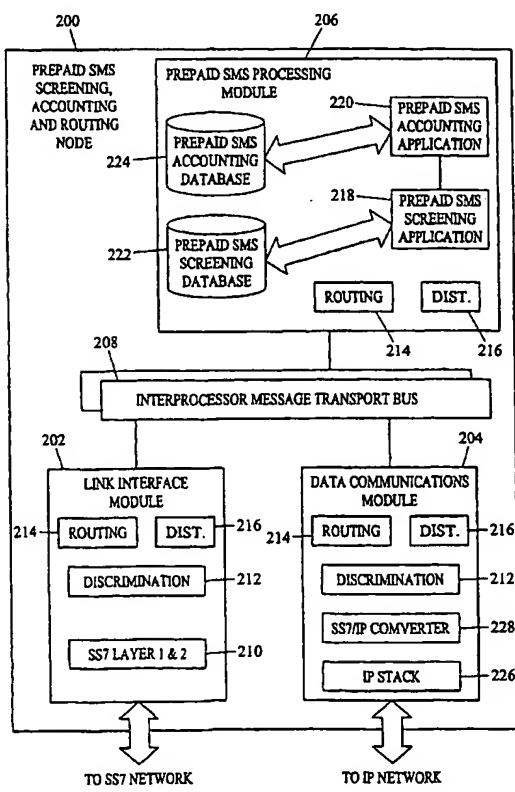
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(54) Title: METHODS AND SYSTEMS FOR TRIGGERLESS PREPAID SMS SCREENING AND ACCOUNTING IN A SIGNALING MESSAGE ROUTING NODE



(57) Abstract: A prepaid SMS screening, accounting, (Fig. 2) and routing node (200) performs prepaid SMS screening and accounting functions. When it receives an SMS message, it determines whether the originating subscriber is a ported subscriber attempting to access an SMSC from the donor network. If it is a ported, and to access the network SMSC, the SMS message may be discarded. If it is not a ported it determines whether it is a prepaid subscriber. If it is a prepaid, and it determines whether the subscriber has sufficient credit to send the SMS message. If it has sufficient credit, the prepaid SMS debits its accounting database and forwards the message to its intended destination. It may also be performed for message directed to subscribers with terminating prepaid SMS service. In such situations, it may screen messages to determine whether the terminating subscriber is a prepaid SMS subscriber, and, if so, debit the terminating subscriber's prepaid SMS account.

WO 03/017697 A1



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Description

METHODS AND SYSTEMS FOR TRIGGERLESS PREPAID SMS
SCREENING AND ACCOUNTING IN A SIGNALING MESSAGE ROUTING
NODE

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Related Applications

This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/312,154, filed August 14, 2001, the disclosure of which is incorporated herein by reference in its entirety.

Technical Field

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The present invention relates to methods and systems for providing triggerless prepaid SMS screening and accounting services. More particularly, the present invention relates to methods and systems for providing triggerless prepaid SMS screening and accounting services in a prepaid SMS screening, accounting, and routing node.

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Background Art

In some mobile communications networks, mobile subscribers prepay a network operator for SMS message service. For example, some mobile subscribers may prepay for the right to send 100 SMS messages in a given month. Other mobile subscribers may not prepay for SMS message service 20 and instead pay after the fact for the amount of SMS messages sent or received within a given month.

Currently, network operators generate intelligent network (IN) queries to an accounting database for SMS messages originating from both prepaid and postpaid mobile subscribers. For prepaid mobile subscribers, the lookup in the 25 database determines whether the mobile subscriber has sufficient credit for sending an SMS message. If the mobile subscriber has sufficient credit, the database returns a response and the SMS message is delivered to its intended recipient. For postpaid mobile subscribers, the lookup in the accounting database is wasteful, since no prepaid SMS information exists in the database 30 for postpaid subscribers. In this case, the database returns a response indicating that the SMS message should be delivered to its intended recipient.

Using IN queries to perform prepaid SMS accounting functions

increases network traffic and delays SMS message delivery. For example, the sending MSC must formulate the IN query and suspend delivery of the SMS message until the response arrives. Formulating IN queries to the accounting database for both prepaid and postpaid subscribers further increases network traffic, SMS message delivery time, and the number of hits to the prepaid SMS accounting database.

Another problem with SMS service relates to number portability. When a mobile subscriber changes service providers and decides to keep his or her mobile telephone number, the telephone number is ported from the original network to the new network. However, the originating mobile subscriber may still have access to the SMSC in the original network because networks typically do not screen SMS messages originated by ported subscribers.

One proposed solution to these problems associated with SMS service is to locate a signaling relay function in the network between a mobile switching center and a pre-paid SMS server. Figure 1 illustrates this solution. In Figure 1, a signaling relay function (SRF) 100 and a prepaid SMS server 102 are located between a mobile switching center (MSC) 104 and a short message service center 106 in a mobile communications network. In this proposed solution, in step 1, MSC 104 originates a mobile-originated forward short message (MO FSM) message to a signaling relay function 100. SRF 100 identifies the operation code of the MO FSM message and analyses the MSISDN of the calling subscriber. In this case, the subscriber is a prepaid SMS subscriber (with information registered in the SRF database), and SRF 100 relays the MO FSM message to a prepaid SMS server 102 (step 2).

In step 3, prepaid SMS server 102 authorises the calling subscriber to send an SMS message. Prepaid SMS server 102 opens a new TCAP dialog towards SMSC 106 by sending a MO FSM message to SRF 100 with SMSC 106 as final destination.

In step 4, SRF 100 relays the MO FSM message to SMSC 106. In step 5, SMSC 106 acknowledges the MO FSM message by sending a MO FSM Ack message directly to prepaid SMS server 102. In step 6, prepaid SMS server

102 acknowledges the MO FSM message received in the step 2 by sending a
FSM MO Ack to SRF **100** with MSC **104** as final destination. In step 7, SRF
100 relays the MO FSM Ack message to MSC **104**.

As illustrated in the solution in Figure 1, locating a signalling relay
5 function and a separate prepaid SMS server in the network results in multiple
MAP messages in the network. For example, in Figure 1, the MAP dialog
between SRF and the prepaid SMS server results in three additional MAP
messages (the MAP MO FSM messages in steps 2 and 3 and the MAP MO
FSM ack message in step 6) for every SMS message sent. In light of the
10 expected increase in SMS traffic in the networks, such additional message
traffic is undesirable.

Another problem with prepaid SMS solutions, such as that illustrated in
Figure 1, relates to prepaid roaming. When an SMS subscriber is roaming,
SMS messages originated by the subscriber must travel to one of the
15 subscriber's home network SMSCs to be delivered to the intended destination.
For IN-based solutions, the MSC in the visited network must query the prepaid
SMS accounting database to determine whether the subscriber has sufficient
prepaid SMS credit to send the message. The home network must depend on
the visited network to make this determination. This is undesirable because it
20 requires the operator of the home network to rely on the visited network for
prepaid SMS screening and accounting. Such a solution is not practical
because a prepaid SMS service provider would be required to have prepaid
SMS accounting agreements with all networks in which any of its subscribers
desires to roam. Thus, there exists a need for improved methods and systems
25 for providing screening service for prepaid SMS messages.

Disclosure of the Invention

The present invention includes improved methods and systems for
prepaid SMS screening and accounting that reduce the number of signaling
messages required for providing prepaid SMS service and that simplify prepaid
30 SMS roaming. According to one aspect of the invention, prepaid SMS
screening, accounting, and routing functions are consolidated in a single
network node. A prepaid SMS screening, accounting, and routing node

determines whether received SMS messages originate from prepaid or postpaid subscribers and performs prepaid SMS accounting functions for those messages that require prepaid service. The prepaid SMS screening, accounting, and routing node may be an SS7 signal transfer point or an SS7/IP gateway. In response to determining that the SMS messages originate from a prepaid subscriber, the prepaid SMS screening, accounting, and routing node performs a lookup in a local prepaid SMS accounting database. If the prepaid SMS screening, accounting, and routing node determines that a prepaid SMS subscriber does not have sufficient credit for sending an SMS message, the prepaid SMS screening, accounting, and routing node forwards a message to an originating node indicating non-delivery of the SMS message. The prepaid SMS screening, accounting, and routing node may also send a new SMS message to the originating subscriber indicating non-delivery of the SMS message. In response to determining that the mobile subscriber has sufficient credit, the prepaid SMS screening, accounting, and routing node forwards the SMS message to its intended destination.

Because the prepaid SMS screening, accounting, and routing node performs a lookup in a screening database to screen SMS messages that are not originated by prepaid subscribers, the load on the accounting database is reduced. In addition, since the accounting database is located internal to the prepaid SMS screening, accounting, and routing node, network traffic is also reduced.

According to another aspect of the invention, the prepaid SMS screening, routing, and accounting node determines whether to allow access to an SMSC. When an SMS message is received, a database lookup is performed to determine whether the SMS message originates from a mobile subscriber of a particular network. If the SMS message did not originate from a mobile subscriber of the particular network, a lookup is performed to determine whether the SMSC ID in the message matches one of the SMSC IDs of the particular network. If the SMSC ID matches, then the message is from a mobile subscriber of another network who is trying to access an SMSC of this

network. In this situation, the mobile subscriber is not permitted to access the SMSC.

The prepaid SMS screening, accounting, and routing node is capable of screening both mobile-originated and mobile-terminated prepaid SMS messages. In addition, the prepaid SMS screening, accounting, and routing node is capable of triggerlessly intercepting SMS messages that are not addressed to the prepaid SMS screening, accounting, and routing node.

Accordingly, it is an object of the invention to provide methods and systems for improved prepaid SMS screening and accounting service.

It is another object of the invention to provide methods and systems for prepaid SMS screening and accounting that enable prepaid SMS roaming.

It is yet another object of the invention to reduce the number of signaling messages required for prepaid SMS service.

Some of the objects of the invention having been stated hereinabove, other objects will become evident as the description proceeds when taken in connection with the accompanying drawings as best described hereinbelow.

Brief Description of the Drawings

Preferred embodiments of the invention will now be explained with reference to the accompanying drawings, of which:

Figure 1 is a block diagram of a conventional solution for providing prepaid SMS screening service;

Figure 2 is a block diagram of a prepaid SMS screening, accounting, and routing node according to an embodiment of the present invention;

Figure 3 is a message flow diagram illustrating exemplary operations performed by a prepaid screening, accounting, and routing node of the present invention in processing an SMS message originated by a prepaid subscriber where the prepaid subscriber has sufficient credit to forward the message;

Figure 4 is a message flow diagram illustrating exemplary processing performed by a prepaid SMS screening, accounting, and routing node according to the invention in blocking certain SMS messages; and

Figures 5A and 5B are a flow chart illustrating exemplary prepaid SMS processing steps that may be performed within a prepaid SMS screening,

accounting, and routing node according to an embodiment of the present invention.

Detailed Description of the Invention

In one embodiment of the invention, both the prepaid SMS screening 5 database and the prepaid SMS accounting database reside within a routing node, such as a signal transfer point or SS7/IP gateway. Figure 2 illustrates a prepaid SMS screening, accounting, and routing node that includes SS7 signal transfer point functionality, SS7/IP gateway functionality, prepaid SMS screening functionality, and prepaid SMS accounting functionality. In Figure 2, 10 prepaid SMS screening, accounting, and routing node 200 includes a link interface module 202, a data communications 204 module, and a prepaid SMS processing module 206 connected via an interprocessor message transport bus 208. Each of the modules may include one or more processing elements and associated control and buffer memory for processing received SMS 15 messages. In one embodiment, each processing module includes an application processor for executing application programs, such as prepaid SMS processing programs and routing programs, and a communications processor for sending and receiving messages over bus 208.

In the illustrated example, link interface module 202 includes SS7 layer 1 20 and 2 applications 210 for performing SS7 layer 1 and 2 functions for SS7 messages. Such functions may include providing a physical layer interface, error detection, error correction, and packet sequencing. A discrimination application 212 analyzes destination point codes in received SS7 messages to determine whether the messages are addressed to prepaid SMS screening, 25 accounting, and routing node 200 or to another node. A routing application 214 routes messages that are addressed to prepaid SMS screening, accounting, and routing node 200. A distribution application 216 distributes messages that are addressed to prepaid SMS screening, accounting, and routing node 200 for further processing.

30 In order to intercept SMS messages that are not addressed to prepaid SMS screening, accounting, and routing node 200, for mobile-originated SMS

messages, discrimination application **212** may also have a list of point codes for all SMSCs in a particular network. In response to receiving a message that is MTP-addressed to one of the SMSCs, discrimination application **212** may forward the message to prepaid SMS processing module **206** for further processing. For mobile-terminated SMS messages, discrimination application **212** may identify messages that originate from an SMSC in a list of SMSCs. Thus, one feature of the present invention is the capability to intercept, screen, and perform accounting for prepaid SMS messages without requiring that the messages be addressed to a specialized processing node. This feature allows prepaid SMS screening, accounting, and routing node **200** to be introduced into a network without requiring MSCs to be reconfigured to address prepaid SMS message to prepaid SMS screening, accounting, and routing node **200**.

Prepaid SMS processing module **206** includes various applications and data structures for providing prepaid SMS screening and accounting functions. In the illustrated example, the functions and database include a prepaid SMS screening application **218**, a prepaid SMS accounting application **220**, a prepaid SMS screening database **222**, and a prepaid SMS accounting database **224**. Prepaid SMS processing module **206** may also include routing and distribution functions **214** and **216** similar to those described above with regard to LIM **202**.

Prepaid SMS screening application **218** determines whether received SMS messages originate from prepaid SMS subscribers or postpaid SMS subscribers by comparing parameter(s) in received SMS messages to parameters stored in prepaid SMS screening database **222**. Messages from prepaid SMS subscribers are forwarded to prepaid SMS accounting application **220**. SMS messages received from post-paid subscribers are forwarded to their intended destinations. Prepaid SMS screening application **218** may also screen SMS messages to determine whether the messages originate from mobile subscribers who have been ported out of a particular service provider's network. In response to determining that a mobile subscriber has been ported

from the network, prepaid SMS screening application 218 may prevent the mobile subscriber from accessing the SMSC in the particular network.

Prepaid SMS accounting application 220 accesses accounting data in prepaid SMS accounting database 224 to determine whether the originating 5 prepaid subscriber has sufficient credit in his or her account to send the prepaid SMS message. The cost for sending the particular SMS message may be determined based on the destination, time of day, size of the message, etc.

In response to determining that the subscriber has sufficient credit to send the SMS message, prepaid SMS accounting application 220 may debit the 10 subscriber's account and forward the message to its intended destination. In response to determining that the prepaid subscriber lacks sufficient credit to send the message, prepaid SMS accounting application 220 may discard the message. In addition, prepaid SMS accounting application 220 may send an error message to the originating node indicating non-delivery of the SMS 15 message and/or an SMS message to the originating subscriber indicating that the message did not go through. For example, the SMS message to the mobile subscriber may indicate that insufficient credit exists in the subscriber's account to send the SMS message.

Although the embodiment illustrated in Figure 2 includes separate 20 prepaid SMS screening and accounting databases, the present invention is not limited to such an embodiment. In an alternate embodiment, the prepaid SMS screening and accounting databases may be combined into a single database without departing from the scope of the invention.

Data communications module 204 sends and receives SS7 messages 25 over an IP network. In the example, data communications module 204 includes an IP protocol stack 226 for sending and receiving messages over an IP network, an SS7/IP converter 228 for converting between SS7 and IP protocol stacks, a discrimination application 212, a routing application 214, and a distribution application 216. The discrimination, distribution, and routing 30 applications perform the same functions as those described with respect to the link interface module. Hence, a description thereof will not be repeated herein.

Although Figure 2 illustrates the prepaid SMS screening and accounting functions as being resident on the same processing module or card within a signaling gateway routing node, the present invention is not limited to such an embodiment. For example, in an alternative embodiment, either or both 5 functions may be located external to the routing node. In such an embodiment, the external SMS screening or accounting processors are preferably coupled to and accessible by the routing node such that the combined elements appear as single node to other network elements. In one example, the prepaid SMS screening and/or accounting functions may be located on a general purpose 10 computing platform coupled to routing node 200 via a local area network.

Figure 3 is a message flow diagram illustrating exemplary processing performed by prepaid SMS screening, accounting, and routing node 200 in processing an SMS message originating from a prepaid subscriber. Referring to Figure 3, in step 1, MSC 104 sends a MAP mobile-originated forward short 15 message message to prepaid SMS screening, accounting, and routing node 200. Prepaid SMS screening, accounting, and routing node 200 identifies the message as an SMS message and performs a lookup in prepaid SMS screening database 222 to determine whether the message is addressed to a prepaid subscriber. In response to determining that the message is directed to 20 a prepaid subscriber, prepaid SMS screening, accounting, and routing node 200 performs a lookup in prepaid SMS accounting database 224. In this example, it is assumed that the subscriber has sufficient credit to send the SMS message. Prepaid SMS screening, accounting, and routing node 200 debits the subscriber's account for sending the SMS message. As mentioned 25 above, the amount that the account is debited may depend on a variety of factors, such as the time of day, the size of the message, or the intended destination.

Because the SMS message passed the screening and because the prepaid subscriber had sufficient credit to send the message, in step 2, prepaid 30 SMS screening, accounting, and routing node 200 sends a MAP mobile-originated forward short message message to SMSC 106. In step 3, SMSC

- 10 -

106 sends a MAP mobile-originated forward short message acknowledgement message to prepaid SMS screening, accounting, and routing node 200. In step 4, prepaid SMS screening, accounting, and routing node 200 forwards the acknowledgement message to MSC 104 ending the short message service
5 transaction.

The message flow illustrated in Figure 3 can be contrasted with that illustrated in Figure 1. In Figure 3, only four MAP messages are required to screen, perform the accounting, and deliver the SMS message. In Figure 1, a total of seven signaling messages are required. Accordingly, prepaid SMS
10 screening, accounting, and routing node 200 according to the present invention greatly reduces SMS signaling message traffic in the network.

Figure 4 is a message flow diagram illustrating exemplary steps performed by prepaid SMS screening, accounting, and routing node 200 for the case where message is blocked, either because a prepaid subscriber lacks
15 sufficient credit or because the prepaid subscriber has been ported from the network and is attempting to use the SMSC or his or her former network. Referring to Figure 4, in step 1, MSC 104 sends a MAP mobile-originated forward short message message to prepaid SMS screening, accounting, and routing node 200. Prepaid SMS screening, accounting, and routing node 200
20 screens the message to determine whether the message is from a prepaid subscriber and whether the subscriber has been ported from the network and is trying to access the SMSC of his or her former network. In this example it is assumed that the message is blocked either because the subscriber lacks sufficient credit or the subscriber has been ported from the network and is
25 trying to access the SMSC of his or her former network. Accordingly, in step ST2, prepaid SMS screening, accounting, and routing node 200 sends a MAP error message to MSC 104 indicating non-delivery of the SMS message. Thus, as illustrated in Figure 1, prepaid SMS screening, accounting, and routing node 200 prevents unauthorized access to a subscriber's short message service
30 center without unduly increasing traffic in the network. Only two messages are required to perform the blocking action. In prior art systems, such as that

illustrated in Figure 1, the SMS server would have to be queried in order to determine whether the subscriber had sufficient credit to send the message, resulting in increased signaling message traffic in the network.

Although Figures 3 and 4 illustrate message flow examples in which a message is addressed to prepaid SMS screening, accounting, and routing node 200, the present invention is not limited to such message flows. As will be described in detail below, a prepaid SMS screening, accounting, and routing node of the present invention is capable of intercepting prepaid SMS messages that are not addressed to it and performing screening and accounting for these messages as well.

Figures 5A and 5B are a flow chart illustrating in detail exemplary processing steps performed by the various applications within prepaid SMS screening, accounting, and routing node 200 in processing received messages.

Referring to Figure 5A, in step **ST1**, prepaid SMS screening, accounting, and routing node 200 receives a message at LIM 202 or DCM 204. In this example, it is assumed that the message is received at LIM 202. In step **ST2**, prepaid SMS screening, accounting, and routing node 200 determines whether the destination point code in the message is equal to the true point code of prepaid SMS screening, accounting, and routing node 200 or to the point code of one of the SMSCs in the service provider's network. For the mobile-terminated case, discrimination function 210 may examine the OPC in the message to determine whether the message is from a predetermined list of SMSCs. If the message is not addressed to one of these point codes, in step **ST3**, prepaid SMS screening, accounting, and routing node 200 routes the message to the processing module associated with the intended destination.

In step **ST4**, if the message contains one of the originating or destination point codes being screened for SMS service, distribution function 216 distributes the message to the appropriate internal processing module. Distribution function 216 may forward all messages having a signaling connection control part to prepaid SMS processing module 206 for prepaid SMS and SCCP processing. The message traverses IMT bus 208 and arrives

at prepaid SMS processing module 206. In step **ST5**, prepaid SMS processing module 206 determines whether the message is a mobile-originated forward short message, a mobile-terminated forward short message message, or a non-FSM message. This step may be performed by looking at the mobile
5 application part operation code in the message to determine MAP message type. If the message is determined to be a mobile-originated non-FSM message, control proceeds to step **ST6** where normal SCCP processing is performed. Such processing may include global title translation. After this processing is performed, routing function 214 may route the message to its
10 intended destination.

The terms "mobile-originated forward short message message" and "mobile-terminated forward short message message" and their associated abbreviations are intended to refer generally to any MAP messages associated with the delivery of a mobile-originated or mobile-terminated SMS message.
15 Such MAP messages include MAP MO FSM and MT FSM messages for MAP implementations that have separate opcodes for these message types. In addition, these terms are intended to include FSM messages for earlier MAP implementations that do not have separate opcodes for MO FSM and MT FSM messages.
20 In step **ST5**, if the message is a MAP mobile-originated forward short message message, control proceeds to step **ST7** where prepaid SMS screening application 218 determines whether the message originates from a ported out subscriber trying to access the SMSC of his or her former network. This step may be performed by examining the MSISDN parameter for the
25 calling party stored in the MAP originating party address and the SMSC ID. If the message is determined to be from a ported out subscriber attempting to access an SMSC of his or her former network, in step **ST8**, prepaid SMS processing is ended and an error message is sent to the MSC indicating non-delivery of the message.
30 In step **ST9**, prepaid SMS screening application 218 determines whether the subscriber is a prepaid subscriber. In this step, prepaid SMS screening

- 13 -

application 218 may perform a lookup in prepaid SMS screening database 222 using calling party information from the message. If the party is determined to be a prepaid subscriber, control proceeds to step ST10 where prepaid SMS accounting database 224 is accessed to determine whether the prepaid 5 subscriber has sufficient credit to send the message. In step ST11, it is determined whether the subscriber has sufficient credit. If the subscriber does not have sufficient credit, the message is preferably not sent, and in step ST12, prepaid SMS screening, accounting, and routing node 200 sends a message to the MSC indicating that the subscriber lacks sufficient credit to send the 10 message and/or sends an SMS message to the originating subscriber indicating non-delivery of the SMS message and the reason for non-delivery.

In step ST13, if the subscriber has sufficient credit, prepaid SMS screening, accounting, and routing node 200 forwards the message to the short message service center for delivery to the destination subscriber. This may 15 include sending the message to the appropriate outbound card and over the network. If the network is an IP network, the message may be encapsulated in an IP packet including appropriate transport adapter layers. Thus, as illustrated in Figures 5A and 5B, all of the steps required to perform prepaid SMS processing are performed within a single prepaid SMS screening, accounting, 20 and routing node. This reduces the message traffic in a service provider's network.

As stated above, prepaid SMS screening, accounting, and routing node 200 may also screen for prepaid terminating subscribers. Returning to step ST5 in Figure 5A, if it is determined that the message is a mobile-terminated 25 forward short message message, control proceeds to Figure 5B where prepaid SMS processing for mobile-terminated SMS messages is performed. Prior to entering Figure 5B, a test may be performed to determine whether the mobile-terminated SMS message originates from a predetermined list of SMSCs for which the recipient pays to receive SMS messages. Examples of such special 30 SMS messages include SMS messages containing sports scores, stock quotes,

news, etc. Alternatively, the recipient may simply agree to prepay for all incoming SMS messages, in which the initial check would be unnecessary.

Referring to steps **ST14** and **ST15** in Figure 5B, prepaid SMS screening application **218** determines whether the recipient is a prepaid subscriber. If the 5 recipient is not prepaid, control proceeds to step **ST16** where prepaid SMS screening, accounting, and routing node **200** forwards the MT FSM message to the MSC of the intended recipient.

In steps **ST17** and **ST18**, if the recipient is a prepaid subscriber, prepaid SMS accounting application **220** accesses the prepaid SMS accounting 10 database to determine whether the recipient has sufficient credit to receive the message. If the recipient does not have sufficient credit to receive the SMS message, control proceeds to step **ST19** where prepaid SMS screening, accounting, and routing node **200** sends messages to the originating SMSC and/or to the recipient indicating non-delivery of the SMS message and the 15 reason for non-delivery. If the intended recipient has sufficient credit to receive the SMS message, control proceeds to step **ST19** where the MT FSM message is forwarded to the MSC of the intended recipient. The MSC then delivers the SMS message to the intended recipient.

Because prepaid SMS screening and accounting functions are 20 performed triggerlessly based on SMS messages received by a prepaid SMS screening, accounting, and routing node, the need for IN queries for prepaid SMS screening and accounting is eliminated. In addition, because SMS screening is performed before accessing the prepaid SMS accounting database, unnecessary accesses to the prepaid SMS accounting database are 25 also eliminated. However, the present invention is not limited to performing prepaid SMS screening prior to accessing the prepaid SMS accounting database. For example, a network service provider may provide only prepaid SMS service. In such a situation, prepaid SMS screening is unnecessary and could be eliminated without departing from the scope of the invention. Even in 30 networks with both prepaid and postpaid subscribers, the prepaid SMS screening function may be eliminated, and the accounting database may be accessed for both prepaid SMS and postpaid SMS subscribers. In such an

embodiment, the present invention still provides a significant advantage over prior art solutions by intercepting SMS messages that are not addressed to a specialized screening node or accounting database and eliminating the need for IN queries.

5 In yet another embodiment of the invention, prepaid SMS accounting database 224 may include entries for both prepaid and postpaid subscribers. For prepaid subscribers, the entries may store the amount of credit that the subscribers have, as described above. For postpaid subscribers, database 224 may create an SMS transaction record for each SMS message sent to or from
10 a particular subscriber. Such a record may include source and destination information, the length of the message, and the time of day that the message was sent. The SMS transaction records may be forwarded to a billing application and used to generate bills for postpaid subscribers.

It will be understood that various details of the invention may be
15 changed without departing from the scope of the invention. Furthermore, the foregoing description is for the purpose of illustration only, and not for the purpose of limitation—the invention being defined by the claims.

CLAIMS

What is claimed is:

1. A method for providing localized prepaid short message service (SMS) screening and accounting, the method comprising:
 - 5 at a prepaid SMS screening, accounting, and routing node:
 - (a) receiving, from an originating node, a first SMS message including mobile subscriber identification information;
 - (b) determining whether the mobile subscriber has prepaid SMS service or post-paid SMS service; and
 - 10 (c) in response to determining that the mobile subscriber has prepaid SMS service, determining whether the mobile subscriber has sufficient prepaid SMS credit for delivery of the first SMS message.
 2. The method of claim 1 wherein receiving a first SMS message from an originating node includes receiving a MAP mobile-originated forward short message message from a mobile switching center.
 - 15 3. The method of claim 1 wherein receiving a first SMS message from an originating node includes receiving a MAP mobile-terminated forward short message message from a short message service center.
 - 20 4. The method of claim 1 wherein receiving a first SMS message from an originating node includes intercepting a MAP mobile-originated forward short message message addressed to a short message service center.
 5. The method of claim 1 wherein receiving a first SMS message from an originating node includes intercepting a MAP mobile-terminated forward short message message.
 - 25 6. The method of claim 1 wherein determining whether the mobile subscriber has prepaid SMS service includes performing a lookup in a prepaid SMS screening database internal to the prepaid SMS screening, accounting, and routing node.
 - 30 7. The method of claim 6 wherein performing a lookup in the prepaid SMS screening database includes performing a lookup using originating mobile subscriber information extracted from the first SMS message to

determine whether the originating mobile subscriber has prepaid SMS service.

8. The method of claim 6 wherein performing a lookup in the prepaid SMS screening database includes performing a lookup using terminating 5 mobile subscriber information extracted from the first SMS message to determine whether the terminating mobile subscriber has prepaid SMS service.

9. The method of claim 1 wherein determining whether the mobile subscriber has sufficient credit for delivery of the first SMS message 10 includes performing a lookup in a prepaid SMS accounting database internal to the prepaid SMS screening, accounting, and routing node.

10. The method of claim 9 wherein performing a lookup in the prepaid SMS accounting database includes performing a lookup using originating 15 mobile subscriber information extracted from the first SMS message to determine whether the originating mobile subscriber has sufficient credit to send the first SMS message.

11. The method of claim 9 wherein performing a lookup in the prepaid SMS accounting database includes performing a lookup using terminating 20 mobile subscriber information extracted from the first SMS message to determine whether the terminating mobile subscriber has sufficient credit to receive the first SMS message.

12. The method of claim 1 comprising, in response to determining that the mobile subscriber has sufficient prepaid credit for delivery of the first SMS message, forwarding the first SMS message to a destination node.

25 13. The method of claim 1 comprising, in response to determining that the mobile subscriber does not have sufficient prepaid credit for delivery of the first SMS message, generating a second SMS message indicating non-delivery of the first SMS message and forwarding the second SMS message to the originating node.

30 14. The method of claim 13 wherein generating a second message includes generating a mobile-originated-forward-short-message error message.

15. The method of claim 1 comprising, in response to determining that the mobile subscriber does not have sufficient prepaid credit for delivery of the first SMS message, discarding the first SMS message.
16. The method of claim 1 comprising, in response to determining that the mobile subscriber does not have sufficient prepaid credit for delivery of the first SMS message, sending an SMS message to the message originator indicating non-delivery of the SMS message and a reason for non-delivery.
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17. The method of claim 1 comprising, in response to determining that the mobile subscriber has post-paid SMS service, forwarding the first SMS message to its intended destination without performing a lookup in a prepaid SMS accounting database.
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18. The method of claim 1 comprising, in response to determining that the mobile subscriber has post-paid SMS service, generating and storing an SMS transaction record for the mobile subscriber.
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19. The method of claim 1 comprising, in response to determining that the mobile subscriber has sufficient credit, debiting an entry in a prepaid SMS accounting database associated with the mobile subscriber.
20. The method of claim 19 wherein debiting an entry includes debiting an entry based on a time of day at which the first SMS message is received.
20
21. The method of claim 19 wherein debiting an entry includes debiting an entry based on the location of the intended recipient of the first SMS message.
22. The method of claim 19 wherein debiting an entry includes debiting an entry based on the size of the first SMS message.
25
23. The method of claim 1 wherein performing steps (a)-(c) at a prepaid SMS screening, accounting, and routing node includes performing steps (a)-(c) at a signal transfer point.
24. The method of claim 1 wherein performing steps (a)-(c) at a prepaid SMS screening, accounting, and routing node includes performing steps (a)-(c) at an SS7/IP gateway.
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25. The method of claim 1 comprising:

- (a) determining whether the mobile subscriber is a subscriber of a first network;
- (b) in response to determining that the mobile subscriber is not a subscriber of the first network, checking an SMSC ID in the first SMS message to determine whether the SMSC ID is of the first network; and
- (c) in response to determining that the SMSC ID is of the first network, preventing the mobile subscriber from accessing the SMSC.

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26. The method of claim 25 comprising, in response to determining that the mobile subscriber is of the first network, allowing the mobile subscriber to access an SMSC in the first network.

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27. A prepaid SMS screening, accounting, and routing node for providing prepaid short message service (SMS) screening, the routing node comprising:

- (a) a link interface module for sending and receiving SMS messages over a network;
- (b) a prepaid SMS screening database including information for identifying prepaid SMS messages;
- (c) a prepaid SMS accounting database including information for determining whether sufficient credit exists in prepaid SMS subscriber accounts for delivery of SMS messages; and
- (d) a prepaid SMS processing module for extracting information from the databases to determine whether SMS messages received by the link interface module require prepaid SMS processing and whether sufficient credit exists in the prepaid subscriber accounts to forward the received SMS messages to their intended destinations.

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30 28. The prepaid SMS screening, accounting and routing node of claim 27 wherein the link interface module is adapted to send and receive SS7-based SMS messages over an SS7 network.

29. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the link interface module is adapted to intercept prepaid SMS messages that are not addressed to the prepaid SMS screening, accounting, and routing node.
- 5 30. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to forward the SMS messages to their intended destinations in response to detecting sufficient credit in the prepaid SMS subscriber accounts.
- 10 31. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to generate a message for notifying a prepaid subscriber of insufficient credit in his or her account in response to determining that the account lacks sufficient credit for delivering an SMS message.
- 15 32. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to discard a received SMS message in response to determining that an originating mobile subscriber lacks sufficient credit in his or her account.
- 20 33. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to discard a received SMS message in response to determining that a terminating mobile subscriber lacks sufficient credit in his or her account.
- 25 34. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to perform a lookup in the prepaid SMS accounting database only in response to determining that a received SMS message originates from a prepaid mobile subscriber.
- 30 35. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to screen SMS messages to determine whether the SMS messages originate from ported-out subscribers attempting to access an SMSC in the subscribers' former networks.

36. The prepaid SMS screening, accounting, and routing node of claim 35 wherein the prepaid SMS processing module is adapted to discard the SMS messages originating from ported out subscribers attempting to access the SMSCs in the subscribers' former networks.
- 5 37. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to debit subscriber accounts based on the time of day that prepaid SMS messages are sent.
- 10 38. The prepaid SMS screening, accounting, and routing node of claim 27 wherein the prepaid SMS processing module is adapted to debit subscriber accounts based on the size of prepaid SMS messages.
- 15 39. A prepaid SMS screening and accounting module comprising:
 - (a) a prepaid SMS screening function for receiving SMS messages and determining whether the SMS messages are associated with prepaid subscribers; and
 - (b) a prepaid SMS accounting function co-located with the prepaid SMS screening function for determining, for the prepaid SMS messages associated with prepaid subscribers, whether the subscribers have sufficient credit for delivery of the SMS messages, and, in response, for sending the SMS messages to their intended destinations.
- 20 40. The prepaid SMS screening and accounting module of claim 39 wherein the prepaid SMS screening function is adapted to determine whether SMS messages originate from ported-out subscribers attempting to access SMSCs of their former networks, and, in response, for discarding the SMS messages.
- 25 41. The prepaid SMS screening and accounting module of claim 39 wherein the prepaid SMS accounting function is adapted to debit prepaid subscriber accounts in response to sending the SMS messages.
- 30 42. The prepaid SMS screening and accounting module of claim 39 wherein the prepaid SMS accounting function is adapted to debit the subscriber accounts based on the time of day that SMS messages are sent.

43. The prepaid SMS screening and accounting module of claim 39 wherein the prepaid SMS accounting function is adapted to debit the subscriber accounts based on the sizes of the SMS messages.
44. The prepaid SMS screening and accounting module of claim 39 comprising a prepaid SMS screening database co-located with the prepaid SMS screening function for storing information for identifying prepaid SMS subscribers.
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45. The prepaid SMS screening and accounting module of claim 39 comprising a prepaid SMS accounting database co-located with the prepaid SMS accounting function for storing account information for prepaid SMS subscribers.
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46. The prepaid SMS screening and accounting module of claim 39 comprising a prepaid SMS screening and accounting database co-located with the prepaid SMS screening and accounting functions for storing information for identifying prepaid SMS subscribers and account information for the prepaid SMS subscribers.
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47. A prepaid SMS accounting and routing module comprising:
 - (a) an SMS accounting database for storing subscriber records for prepaid and post-paid SMS subscribers;
 - 20 (b) an SMS accounting function operatively associated with the SMS accounting database for accessing the subscriber records in response to received SMS messages to determine whether prepaid subscribers have sufficient credit for delivery of SMS messages and to record SMS transaction information for prepaid and post-paid subscribers; and
 - (c) a routing function operatively associated with the SMS accounting function for routing SMS messages for prepaid subscribers with sufficient credit and SMS messages for post-paid subscribers to destination nodes.

1/6

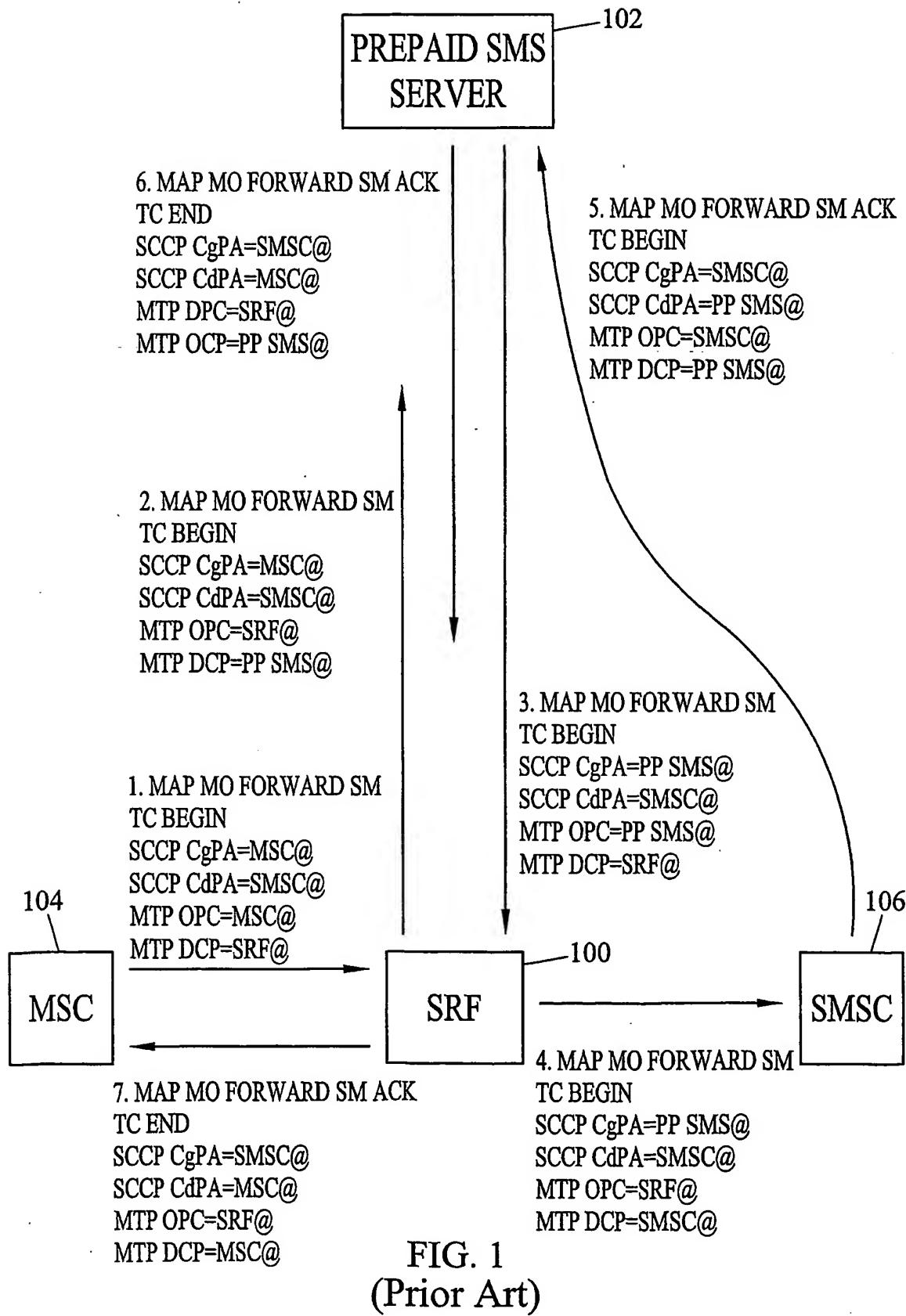


FIG. 1
(Prior Art)

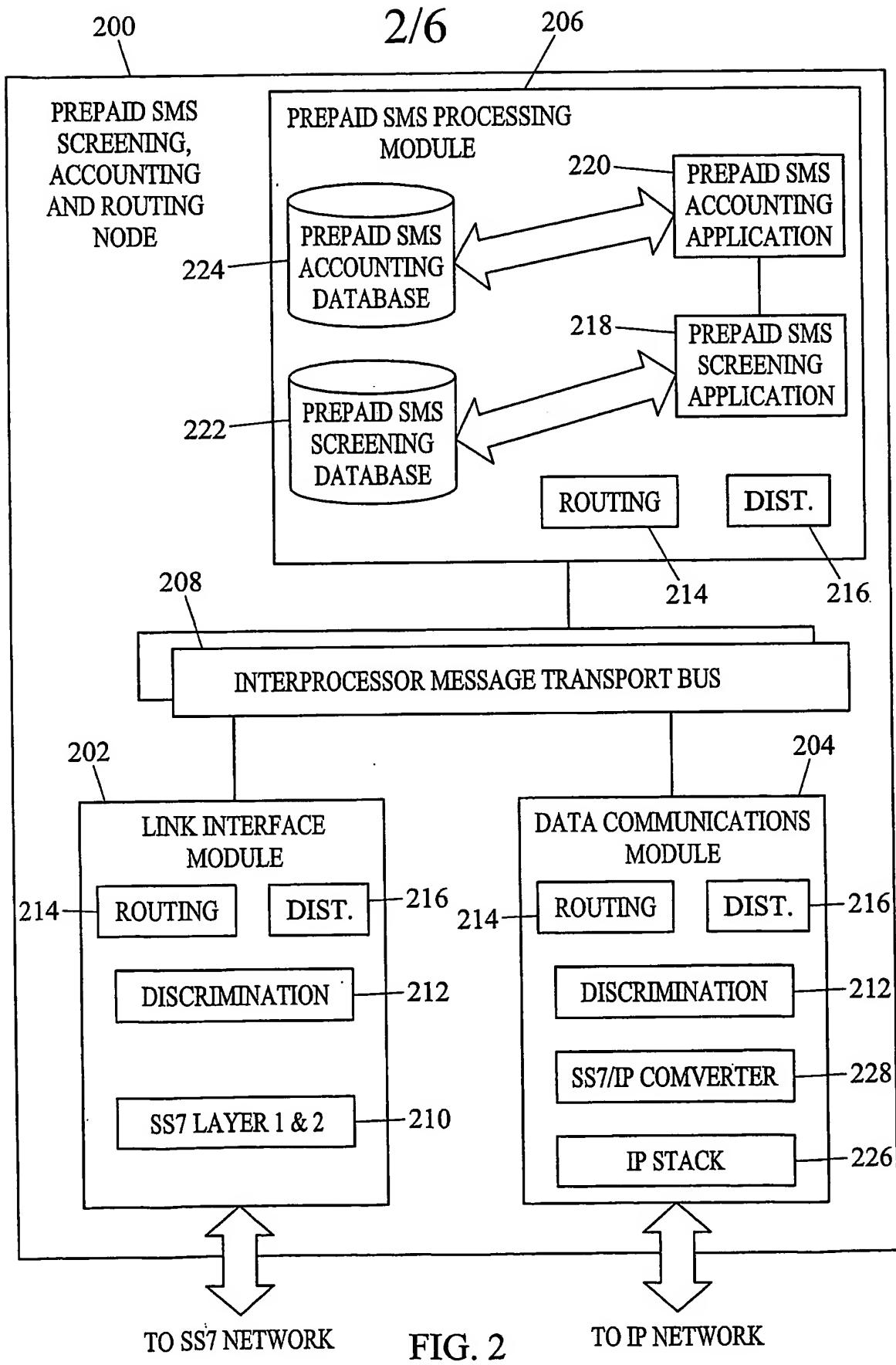


FIG. 2

3/6

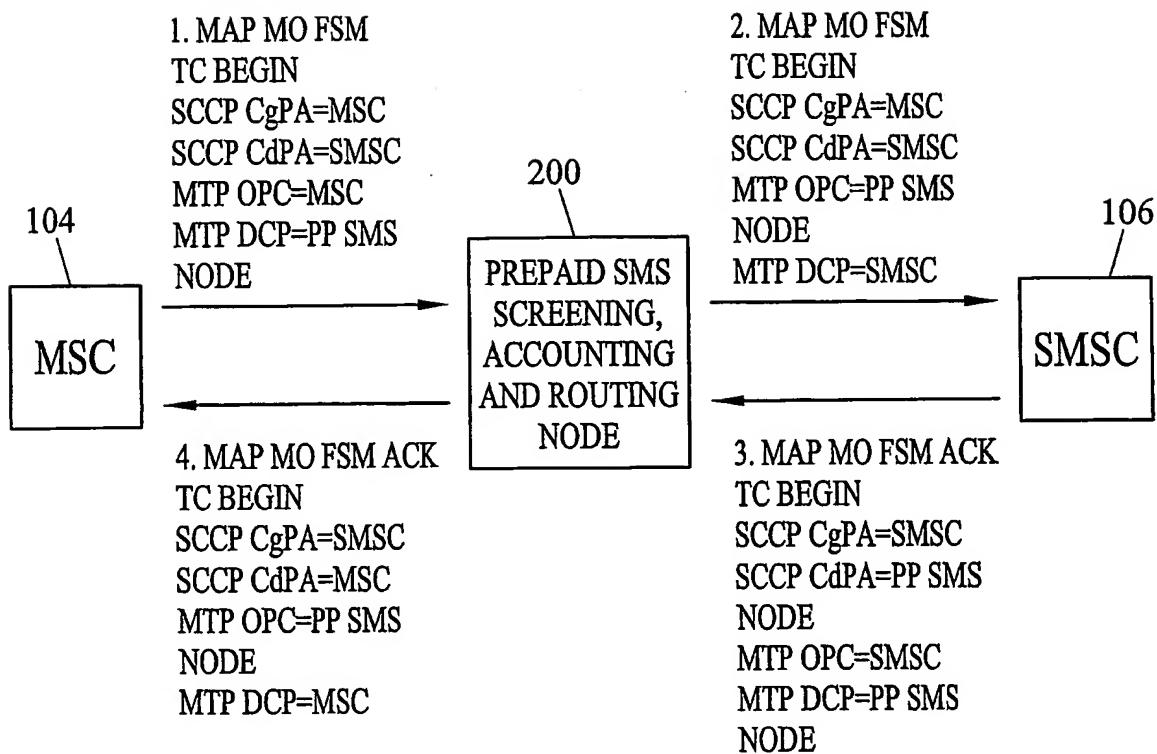


FIG. 3

4/6

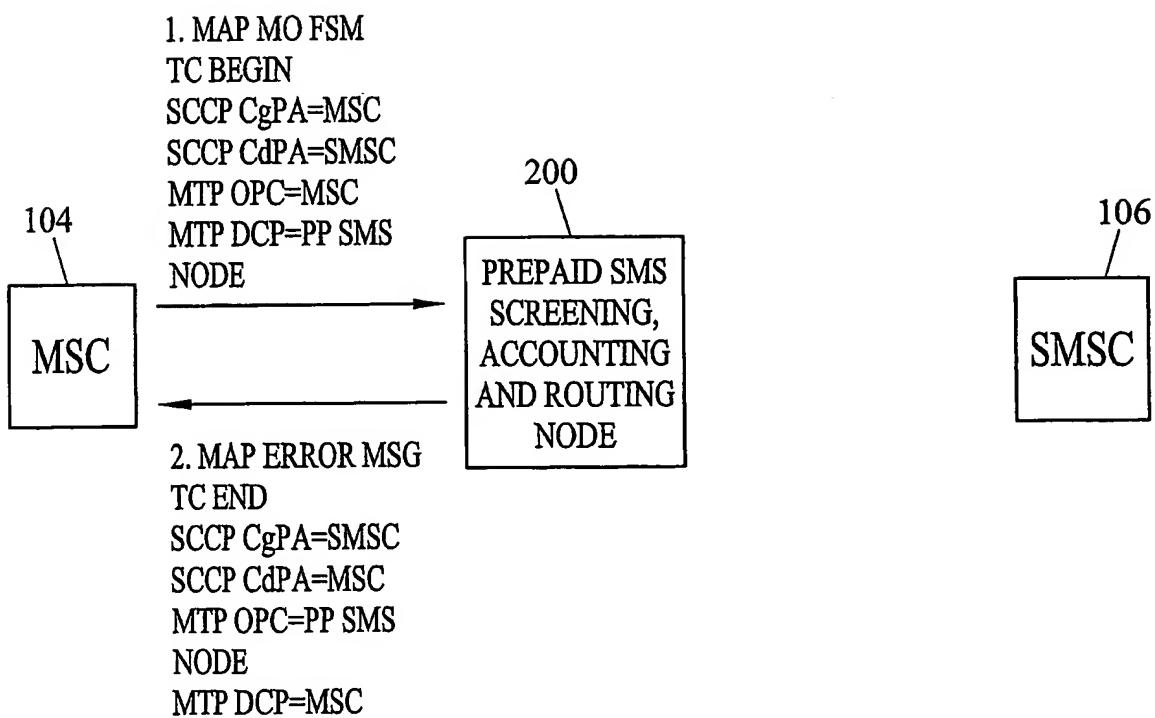
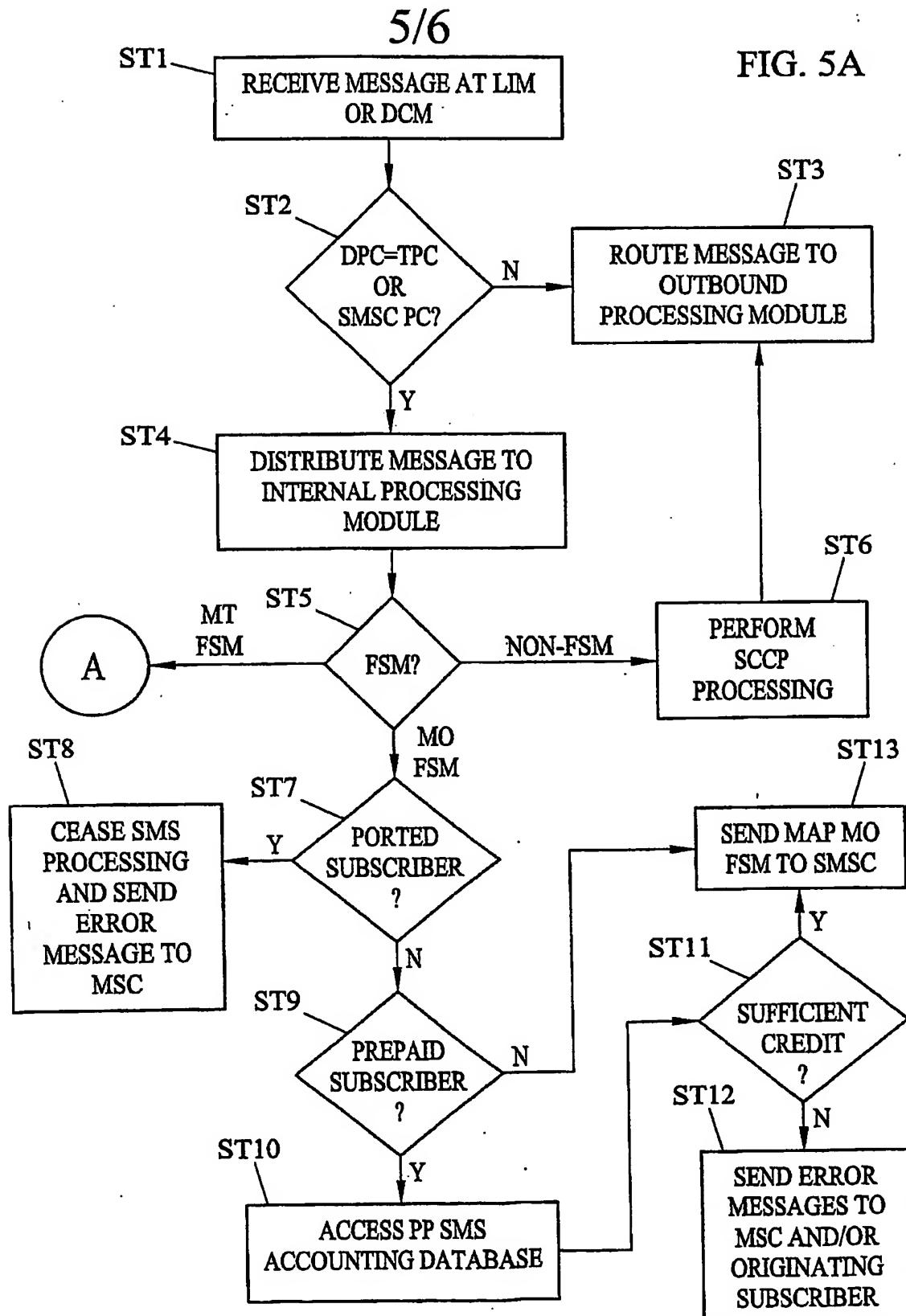


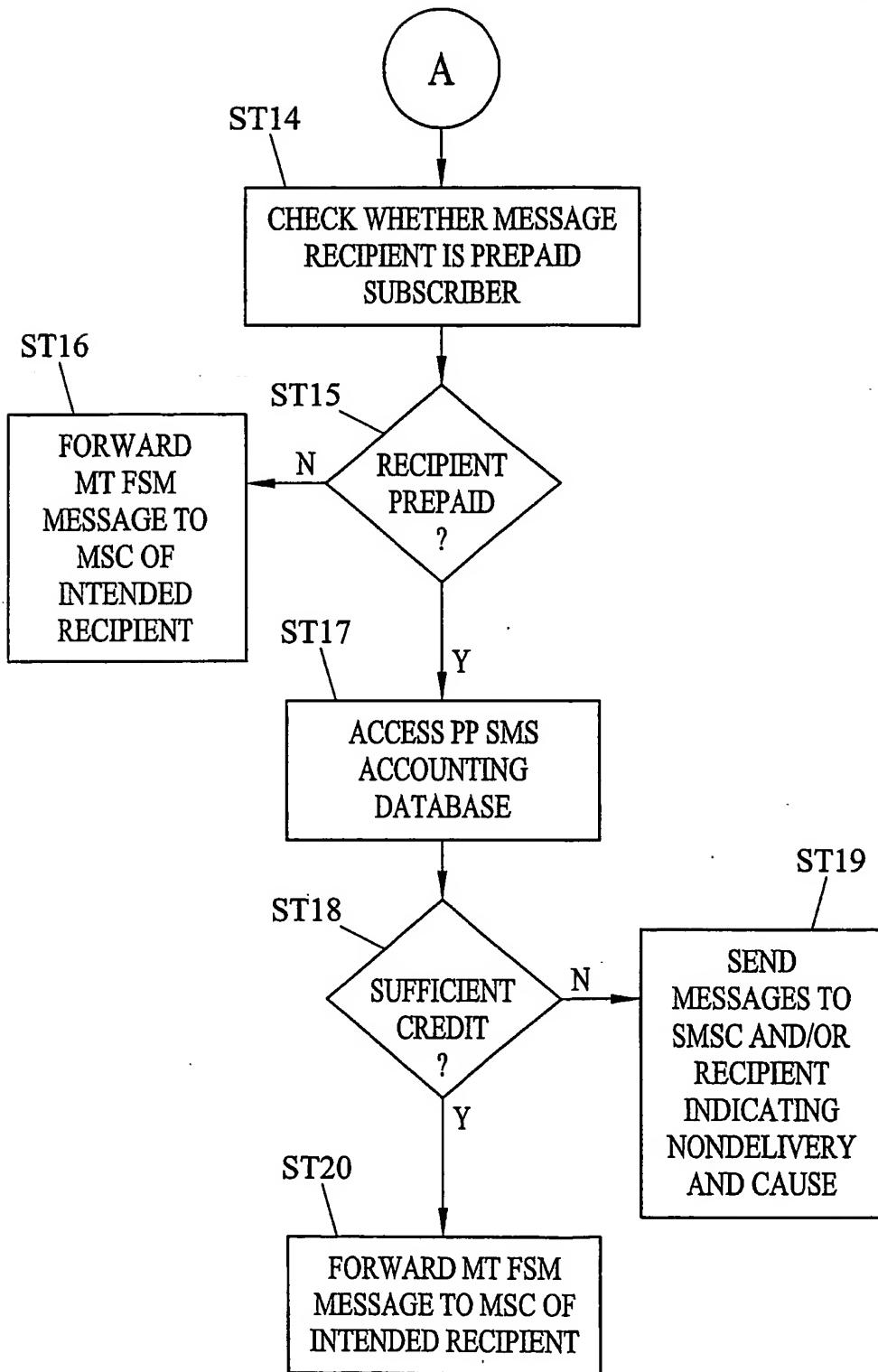
FIG. 4

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6/6

FIG. 5B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/25789

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04Q 7/20
 US CL : 455/466, 408, 406

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/466, 408, 406, 407, 445

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,915,222 A (OLSSON et al) 22 JUNE 1999, Fig. 1-5, col. 2 lines 46-62.	1-47
A	US 5,995,822 A (SMITH et al) 30 NOVEMBER 1999, Fig. 1-3, col. 4, lines 16-24.	1-47

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

12 NOVEMBER 2002

Date of mailing of the international search report

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